PLANAR LIGHT SOURCE

Patent Number: JP7176794
Publication date: 1995-07-14
Inventor(s): SHIMIZU YOSHINORI
Applicant(s): NICHIA CHEM IND LTD
Requested Patent: ☐ JP7176794
Application Number: JP19930318276 19931217
Priority Number(s):
IPC Classification: H01L33/00; G09F9/00
EC Classification:
Equivalents:

Abstract

PURPOSE:To provide a planar light source wherein a blue light emitting diode is used and white luminescence is feasible, and wherein uniform white luminescence can be observed.
CONSTITUTION:Light emitting diodes 1 are optically connected with the end of a transparent light transmitting plate 2. A fluorescent substance that emits light when energized by the luminescence of the blue light emitting diodes 1 and white powder that scatters fluorescence, are mixed. The resultant mixture is applied to either of the major surfaces of the light transmitting plate 2 to form a fluorescence scattering layer 3. The wavelength of the luminescence of the blue light emitting diodes 1 is changed through the fluorescence scattering layer 3.

(19)日本国特許庁（ＪＰ）　(12) 公開特許公報（A）　(11)特許出願公開番号

特開平7－176794

(43)公開日　平成７年(1995)７月14日

(51)Int.Cl.[6]	識別記号	庁内整理番号	ＦＩ	技術表示箇所
Ｈ０１Ｌ　33/00		Ｎ		
Ｇ０９Ｆ　9/00	３３６	Ｈ　7610－5G		

審査請求　未請求　請求項の数２　ＯＬ　（全４頁）

(21)出願番号　特願平5－318276

(22)出願日　平成５年(1993)12月17日

(71)出願人　000226057
日亜化学工業株式会社
徳島県阿南市上中町岡491番地100

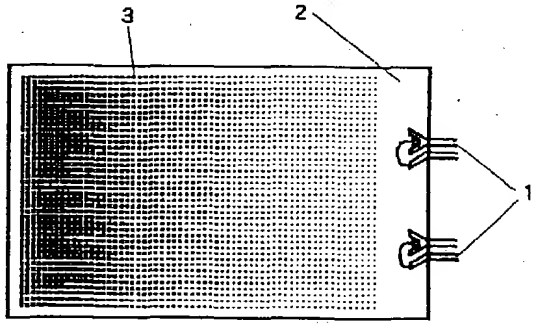
(72)発明者　清水　義則
徳島県阿南市上中町岡491番地100　日亜化学工業株式会社内

(54)【発明の名称】　面状光源

(57)【要約】

【目的】　青色発光ダイオードを用いた白色可能な面状光源を実現し、均一な白色発光を観測できる面状光源を提供する。

【構成】　透明な導光板の端面に発光ダイオードが光学的に接続されており、さらに前記導光板の主面のいずれか一方に、前記青色発光ダイオードの発光により励起されて蛍光を発する蛍光物質と、蛍光を散乱させる白色粉末とが混合された状態で塗布された蛍光散乱層を有し、前記青色発光ダイオードの発光が前記蛍光散乱層で波長変換される。



1

【特許請求の範囲】

【請求項１】　透明な導光板の端面の少なくとも一箇所に青色発光ダイオードが光学的に接続されており、さらに前記導光板の主面のいずれか一方に、前記青色発光ダイオードの発光により励起されて蛍光を発する蛍光物質と、蛍光を散乱させる白色粉末とが混合された状態で塗布された蛍光散乱層を有し、前記青色発光ダイオードの発光が前記蛍光散乱層で波長変換され、前記蛍光散乱層と反対側の導光板の主面側から観測されることを特徴とする面状光源。

【請求項２】　前記青色発光ダイオードは、その主発光波長が５００ｎｍよりも短く、発光出力が５００μＷ以上であることを特徴とする請求項１に記載の面状光源。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明はディスプレイのバックライト、照光式操作スイッチ等に使用される面状の光源に係り、特に液晶ディスプレイのバックライトとして好適に用いることができる面状光源に関する。

【０００２】

【従来の技術】一般にノート型パソコン、ワープロ等に使用される液晶ディスプレイのバックライト用の面状光源には、例えばＥＬ、冷陰極管が使用されている。ＥＬはそれ自体が面状光源であり、冷陰極管は拡散板を用いて面状光源とされ、現在それらのバックライトの発光色はほとんどが白色とされている。

【０００３】一方発光ダイオード（以下ＬＥＤと記す。）もバックライト用光源として一部利用されている。しかしＬＥＤを用いて白色発光を得る場合、従来では青色ＬＥＤの発光出力が数十μＷほどしかないため、他の赤色ＬＥＤ、緑色ＬＥＤを用いて白色発光を実現させるには、それら各色発光ＬＥＤの特性を合致させにくく色変化が大きいという欠点がある。また、三原色のＬＥＤを集合させて、同一平面上に幾何学的に同じ位置に配置しても、バックライトとしてはそれらのＬＥＤを接近した位置で視認するため、均一な白色光源にすることは不可能であった。従って現在白色の液晶バックライトの面状光源には、大型では冷陰極管、小型～中型にはＥＬと使い分けられているのが現状で、ＬＥＤを用いた白色発光のバックライトはほとんど知られていない。

【０００４】また白色発光、あるいはモノクロの光源として、一部では青色ＬＥＤチップの周囲を蛍光物質を含む樹脂で包囲して色変換する試みもあるが、チップ周辺は太陽光よりも強い放射強度の光線にさらされるため、蛍光物質の劣化が問題となり、特に有機蛍光顔料で顕著である。更にイオン性の有機染料はチップ近傍では直流電界により電気泳動を起こし、色調が変化する可能性がある。また従来の青色ＬＥＤは蛍光物質で色変換するには十分な出力を有しておらず、たとえ色変換したとしても実用できるものではなかった。

2

【０００５】

【発明が解決しようとする課題】本発明はこのような欠点を解決するために成されたもので、その目的とするところは、ＬＥＤを用い、主としてバックライトとして利用できる白色発光可能な面状光源を実現すると共に、均一な白色発光を観測できる面状光源を提供することにあり、さらには白色以外の任意色の発光が可能な面状光源を提供し、信頼性に優れたＬＥＤの特性を利用し、各種操作スイッチ等に利用することにある。

【０００６】

【課題を解決するための手段】本発明の面状光源は、透明な導光板の端面の少なくとも一箇所に青色ＬＥＤが光学的に接続されており、さらに前記導光板の主面のいずれか一方に、前記青色発光ダイオードの発光により励起されて蛍光を発する蛍光物質と、光を散乱させる白色粉末とが混合された状態で塗布された蛍光散乱層（以下、蛍光散乱層側の主面を第二の主面という。）を有し、前記青色発光ダイオードの発光の一部が前記蛍光散乱層で波長変換され、前記蛍光散乱層と反対側の導光板の主面（以下発光観測側の主面を第一の主面という。）側から観測されることを特徴とする。

【０００７】図１は本発明の面状光源の導光板２を蛍光散乱層３側から見た平面図である。導光板２は例えばアクリル、硝子等の透明な材料よりなり、その導光板２の端面に青色ＬＥＤ１が埋設されることにより、導光板２と青色ＬＥＤ１とが光学的に接続されている。なお本発明において、青色ＬＥＤ１と導光板２の端面とが光学的に接続されているとは、簡単に言えば、導光板２の端面から青色ＬＥＤの光を導入することをいい、例えばこの図に示すように青色ＬＥＤ１を埋設することはもちろんのこと、青色ＬＥＤを接着したり、また、光ファイバー等を用いて導光板２の端面に青色ＬＥＤの発光を導くことによって実現可能である。

【０００８】次に、蛍光散乱層３は、所望の色が観測できるように、蛍光物質と白色顔料とを調合したインクが塗布されてなり、青色ＬＥＤ１の発光を蛍光物質で波長変換すると同時に、白色顔料でその蛍光を導光板２内に散乱させている。特に図１では前記蛍光散乱層３をドット状とし、第一の主面側の表面輝度が一定となるように、ＬＥＤ１に接近するにつれて、第二の主面側の単位面積あたりの蛍光散乱層３の面積を減じるようなパターンとし、さらにはＬＥＤ１と最も離れた第二の主面の端部の面積はやや最大面積に比して若干小さくしている。ここで、図１中の■は蛍光散乱層３のパターンを表している。図１では青色ＬＥＤを一つの端面に２個配した構造としているが、導光板が四角形であれば四方の端面全てにＬＥＤを接続してもよいことはいうまでもなく、ＬＥＤの個数も限定するものではない。さらに、ＬＥＤの配置状況により、第一の主面側から観測する発光を面状均一とするように蛍光散乱層の塗布形状、塗布状態を適

宜変更することができる。

【０００９】

【作用】図２は本発明の面状光源を例えば液晶パネルのバックライトとして実装した場合の模式断面図である。これは図１に示す面状光源の第二の主面側に、例えばチタン酸バリウム、酸化チタン、酸化アルミニウム等よりなる散乱反射層６と、例えばＡｌよりなるベース７とが積層された反射板を設置し、第一の主面側に表面が凹凸とされている光拡散板５を設置しており、これらの構成は光源を冷陰極管とするバックライトと特に変わるものではない。

【００１０】まず図２の矢印で示すように、青色ＬＥＤ１から出た光は、チップ近傍で一部導光板以外の外部に放射されるが、大部分の光は導光板２の中を全反射を繰り返しながら、導光板の端面に達する。端面に達した光は端面全てに形成された反射膜４に反射されて、全反射を繰り返す。この時、導光板２の第二の主面側に設けられた蛍光散乱層３により一部の光は散乱され、また一部の光は蛍光物質により吸収され同時に波長変換されて放射され、導光板２の第一の主面側から観測する発光色はこれらの光を合成した光が観測できる。例えば橙色の蛍光顔料と白色顔料からなる蛍光散乱層３を設けた面状光源では、先に述べた作用により、青色ＬＥＤからの発光色が白色となって観測できる。また色調は蛍光物質の種類と白色顔料の混合比により任意に調整できる。特に本発明では一つの青色ＬＥＤの発光波長はその主発光ピークが５００ｎｍよりも短く、その発光出力は２００μＷ以上、更に好ましくは３００μＷ以上の出力が必要である。なぜなら発光波長が５００ｎｍ以上であると全ての色が実現しにくくなり、またその発光出力が２００μＷよりも少ないと、たとえ導光板の端面に光学的に接続する青色ＬＥＤの数を増やしても、充分な明るさの均一な面状発光の光源が得られにくい傾向にあるからである。

【００１１】

【実施例】

［実施例１］厚さ約２ｍｍのアクリル板の片面に、図１に示すドット状のパターンで、蛍光散乱層３をスクリーン印刷により形成した。蛍光散乱層３は、赤色蛍光顔料であるシンロイヒ化学製ＦＡ－００１と緑色蛍光顔料である同社製ＦＡ－００５とを等量に混合した蛍光顔料と、白色粉末としてチタン酸バリウムとを重量比で１：５の割合で混合し、それをアクリル系バインダー中に分散したものを印刷して形成した。

【００１２】次に上記のようにして蛍光散乱層が形成されたアクリル板を、所望のパターンに従って切断し、アクリル板の端面（切断面）を全て研磨した後、研磨面にＡｌよりなる反射層４を形成することにより、蛍光散乱層３が形成された導光板２を得た。

【００１３】前記導光板２の端面に二箇所、穴を設け、その穴に発光波長４８０ｎｍ。発光出力１２００μＷを有する窒化ガリウム系化合物半導体よりなる青色ＬＥＤをそれぞれ１個づつ埋め込むことにより、本発明の面状光源を得た。この面状光源の青色ＬＥＤを同時に点灯させたところ、導光板２の発光観測面側からはやや黄色みを帯びた白色のほぼ均一な面状発光が得られた。さらに、発光観測面側に予めマット加工が施された光拡散板５と、蛍光散乱層３側にＡｌベース７上にチタン酸バリウム層６が塗布された反射板を設置して、バックライト用光源としたところ、光拡散板５側から完全に面状均一な白色発光が得られた。輝度は５５ｃｄ／ｍ²であった。

【００１４】［実施例２］蛍光散乱層３を、黄色蛍光染料としてＢＡＳＦ社のＬｕｍｏｇｅｎＦ　Ｙｅｌｌｏｗ－０８３と橙色蛍光染料として同社製Ｏｒｅｎｇｅ－２４０とをほぼ等量混合し、それらをブチルカルビトールアセテートに溶解した蛍光染料と、白色物質としてチタン酸バリウムとを重量比で１（染料）：２００の割合で混合したものを用いて形成する他は、実施例１と同様にして本発明の面状光源を得たところ、ほぼ均一な面状発光が観測された。さらに同様にしてバックライト用光源としたところ、完全に均一な面状発光が観測された。

【００１５】

【発明の効果】以上説明したように、本発明の面状光源は、青色ＬＥＤを用い、しかも導光板の片方の面に青色ＬＥＤにより波長変換できる蛍光物質と白色粉末とを含有した蛍光散乱層を有していることにより、信頼性に優れたＬＥＤによる面状光源を実現することが可能となった。しかも蛍光散乱層の白色粉末は、蛍光物質により波長変換された光を反射、拡散させる作用があるため、使用する蛍光物質の使用量が少なくて済む。更に好都合なことには、ＬＥＤチップと蛍光物質とが直接接することがないので、蛍光物質の劣化が少なく、長期間に渡って面状光源の色調変化を起こすことがない。さらに、色調に関しては、蛍光物質、白色粉末の種類、混合量等を変更することにより、白色を含め任意の色調を提供することができる。

【００１６】一方蛍光散乱層を励起する側として、最も好ましくは使用する青色ＬＥＤの発光出力が２００μＷ以上のものとすることにより、蛍光物質により効率的に波長変換して大きな面積の明るい面状光源を実現することができる。このように、本願の面状光源は、バックライト用光源とだけでなく、蛍光物質を利用した照光式操作スイッチ等に利用することもできる。

【図面の簡単な説明】

【図１】　本発明の一実施例の面状光源の導光板２を蛍光散乱層３側から見た平面図。

【図２】　本発明の一実施例の面状光源をバックライトとして実装した場合の模式断面図。

【符号の説明】

１・・・・・青色ＬＥＤ

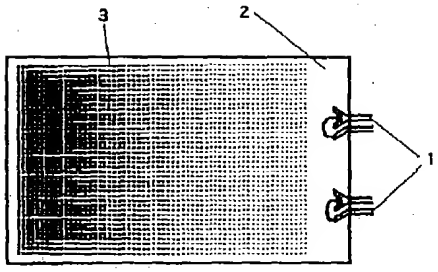
5

2・・・・・導光板、
3・・・・・蛍光散乱層
4・・・・・反射層

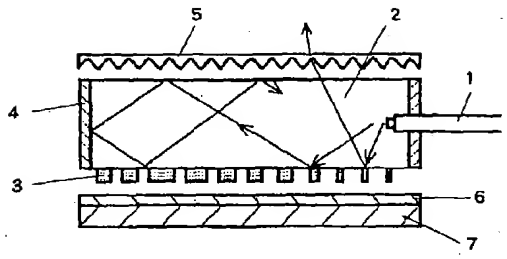
6

＊5・・・・・光拡散板
6・・・・・散乱反射層
＊　7・・・・・Ａｌベース

【図１】



【図２】



2/8

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 07-176794
(43)Date of publication of application : 14.07.1995

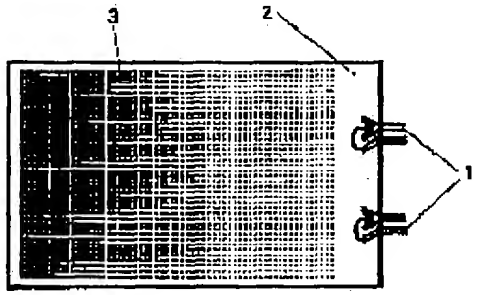
(51)Int.Cl. H01L 33/00
G09F 9/00

(21)Application number : 05-318276
(22)Date of filing : 17.12.1993

(71)Applicant : NICHIA CHEM IND LTD
(72)Inventor : SHIMIZU YOSHINORI

(54) PLANAR LIGHT SOURCE

(57)Abstract:
PURPOSE: To provide a planar light source wherein a blue light emitting diode is used and white luminescence is feasible, and wherein uniform white luminescence can be observed.
CONSTITUTION: Light emitting diodes 1 are optically connected with the end of a transparent light transmitting plate 2. A fluorescent substance that emits light when energized by the luminescence of the blue light emitting diodes 1 and white powder that scatters fluorescence, are mixed. The resultant mixture is applied to either of the major surfaces of the light transmitting plate 2 to form a fluorescence scattering layer 3. The wavelength of the luminescence of the blue light emitting diodes 1 is changed through the fluorescence scattering layer 3.



LEGAL STATUS

[Date of request for examination]	15.05.1996
[Date of sending the examiner's decision of rejection]	
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	application converted
[Date of final disposal for application]	21.04.1997
[Patent number]	
[Date of registration]	
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

* NOTICES *

CLAIMS

[Claim(s)]

[Claim 1] The fluorescent substance which blue light emitting diode is optically connected to at least one place of the end face of a transparent light guide plate, is further excited by luminescence of the aforementioned blue light emitting diode by either of the principal planes of the aforementioned light guide plate, and emits fluorescence, The field-like light source which it has the fluorescence scattering layer applied where the white powder over which fluorescence is scattered is mixed, and wavelength conversion of the luminescence of the aforementioned blue light emitting diode is carried out by the aforementioned fluorescence scattering layer, and is characterized by being observed from the principal plane side of the light guide plate of the aforementioned fluorescence scattering layer and an opposite side.

[Claim 2] The aforementioned blue light emitting diode is the field-like light source according to claim 1 characterized by the main luminescence wavelength being shorter than 500nm, and a radiant power output being more than 500microW.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] this invention relates to the field-like light source which can be applied to the light source of the shape of a field used for the back light of a display, an illumination formula operation switch, etc., especially can be suitably used as a back light of a liquid crystal display.

[0002]

[Description of the Prior Art] EL and the cold cathode tube are used for the field-like light source for the back lights of the liquid crystal display generally used for a notebook sized personal computer, a word processor, etc. Itself of EL is the field-like light source, a cold cathode tube is used as the field-like light source using a diffusion board, and the luminescent color of those back lights is made white [most] now.

[0003] On the other hand, light emitting diode (it is described as Following Light Emitting Diode.) is also used in part as the light source for back lights. However, by the former, when obtaining white luminescence using Light Emitting Diode, since there is no radiant power output of blue Light Emitting Diode as several 10microW, in order to make white luminescence realize using other Red Light Emitting Diode and green Light Emitting Diodes, there is a fault that color change is large that it is hard to make the property of each [these] color luminescence Light Emitting Diode agree. Moreover, since those Light Emitting Diodes were checked by looking as a back light in the near position even if it gathers Light Emitting Diode in three primary colors and arranges geometrically to a coplanar in the same position, it was impossible to have made it the uniform white light source. Therefore, if large-sized, the present condition is properly used with EL, and most back lights of white luminescence using Light Emitting Diode are not known by a cold cathode tube, small - the medium size now at the white field-like light source of a liquid crystal back light.

[0004] Moreover, as the light source of white luminescence or monochrome, although the attempt which surrounds the circumference of a blue Light Emitting Diode chip by the resin containing a fluorescent substance partly, and carries out color conversion also occurs, since the chip circumference is exposed to the beam of light of intensity of radiation stronger than sunlight, degradation of a fluorescent substance poses a problem, especially it is remarkable at an organic fluorescent pigment. Furthermore, an ionicity organic dye may cause electrophoresis by direct-current electric field near the chip, and a color tone may change. Moreover, the conventional blue Light Emitting Diode was not a thing usable even if it does not have sufficient output to carry out color conversion but carries out color conversion with a fluorescent substance.

[0005]

[Problem(s) to be Solved by the Invention] The place which accomplished in order that this invention might solve such a fault, and is made into the purpose While realizing the field-like light source which can be used mainly as a back light and for which light can be emitted white using Light Emitting Diode It is in offering the field-like light source which can observe uniform white luminescence, and is in offering the field-like light source which can emit light for arbitrary colors other than white further, using the property of Light Emitting Diode excellent in reliability, and using for various operation switches etc.

[0006]

[Means for Solving the Problem] The fluorescent substance which, as for the field-like light source of this invention, blue Light Emitting Diode is optically connected to at least one place of the end face of a transparent light guide plate, is further excited by luminescence of the aforementioned blue light emitting diode by either of the principal planes of the aforementioned light guide plate, and emits fluorescence, The fluorescence scattering layer applied where the white powder over which light is scattered is mixed (the principal plane by the side of a fluorescence scattering layer is hereafter called second principal plane.) It has, wavelength conversion of a part of luminescence of the aforementioned blue light emitting diode is carried out by the aforementioned fluorescence scattering layer, and it is the principal plane (the principal plane by the side of luminescence observation is called first principal plane below.) of the light guide plate of the aforementioned fluorescence scattering layer and an opposite side. It is characterized by being observed from a side.

[0007] Drawing 1 is the plan which looked at the light guide plate 2 of the field-like light source of this invention from the fluorescence scattering layer 3 side. A light guide plate 2 consists of transparent material, such as an acrylic and glass, and the light guide plate 2 and blue Light Emitting Diode1 are optically connected by laying blue Light Emitting Diode1 under the end face of the light guide plate 2. In addition, if it says simply that blue Light Emitting Diode1 and the end face of a light guide plate 2 are connected optically in this invention, it is realizable by pasting up blue Light Emitting Diode and leading luminescence of blue Light Emitting Diode to the end face of a light guide plate 2 using an optical fiber etc. not to mention laying blue Light Emitting Diode1 underground, as it says introducing the light of blue Light Emitting Diode from the end face of a light guide plate 2, for example, is shown in this drawing.

[0008] Next, the fluorescence scattering layer 3 is scattering the fluorescence in a light guide plate 2 by white pigments at the same time it comes to apply the ink which prepared a fluorescent substance and white pigments and it carries out wavelength conversion of the luminescence of blue Light Emitting Diode1 with a fluorescent substance so that a desired color can be observed. The aforementioned fluorescence scattering layer 3 is especially made into the shape of a dot by drawing 1 , it considers as a pattern which reduces the area of the fluorescence scattering layer 3 per unit area by the side of the second principal plane, and Light Emitting Diode1 and area of the most distant edge of the second principal plane are further made small a little as compared with the maximum area as Light Emitting Diode1 is approached so that the surface brightness by the side of the first principal plane may become fixed. Here, ** in drawing 1 expresses the pattern of the fluorescence scattering layer 3. Although considered as the structure which allotted two blue Light Emitting Diodes to one

end face in drawing 1 , if a light guide plate is a square, to say nothing of connecting Light Emitting Diode, the number of Light Emitting Diode will not be limited to all end faces on all sides. Furthermore, the application configuration of a fluorescence scattering layer and an application state can be suitably changed so that luminescence observed from a first principal plane side may be made into field-like homogeneity according to the arrangement situation of Light Emitting Diode.

[0009]
[Function] Drawing 2 is a type section view at the time of mounting the field-like light source of this invention as a back light of a liquid crystal panel. With the scatter reflection layer 6 which consists of a barium titanate, titanium oxide, an aluminum oxide, etc., the reflecting plate to which the laminating of the base 7 which consists of aluminum was carried out is installed, this is installing the optical diffusion board 5 with which the front face is made into irregularity at the first principal plane side at the second [of the field-like light source shown in drawing 1] principal plane side, and these composition does not change especially with the back light which makes the light source a cold cathode tube.
[0010] Although the light which came out of blue Light Emitting Diode1 is emitted to the exteriors other than a light guide plate in part near the chip as the arrow of drawing 2 shows first, a great portion of light reaches the end face of a light guide plate in the inside of a light guide plate 2, repeating total reflection. It is reflected by the reflective film 4 formed in all end faces, and the light which reached the end face repeats total reflection. At this time, a part of light is absorbed with a fluorescent substance, and wavelength conversion is carried out simultaneously, they is emitted [a part of light is scattered about by the fluorescence scattering layer 3 prepared in the second / of a light guide plate 2 / principal plane side, and], and the luminescent color observed from a first [of a light guide plate 2] principal plane side can observe the light which compounded such light. For example, in the field-like light source which formed the fluorescence scattering layer 3 which consists of an orange fluorescent pigment and orange white pigments, by the operation described previously, the luminescent color from blue Light Emitting Diode becomes white, and can observe. Moreover, the kind of fluorescent substance and the mixing ratio of white pigments can adjust a color tone arbitrarily. At this invention, the main luminescence peak of especially the luminescence wavelength of one blue Light Emitting Diode is shorter than 500nm, and the radiant power output needs the output more than 300microW still more preferably more than 200microW. It is because it is in the inclination for the light source of field-like luminescence with sufficient uniform luminosity to be hard to be obtained even if it increases the number of blue Light Emitting Diodes which connects with the end face of a light guide plate optically even if, when it is it hard coming to realize all colors that luminescence wavelength is 500nm or more and there are few the radiant power outputs than 200microW.
[0011]
[Example]
The fluorescence scattering layer 3 was formed in one side of an acrylic board with a [example 1] thickness of about 2mm by screen-stencil by the pattern of the shape of a dot shown in drawing 1 . the product made from SHINROIHI chemistry whose fluorescence scattering layer 3 is a red fluorescent pigment -- the company make which is FA-001 and a green fluorescent pigment -- 1:5 came out of the barium titanate comparatively by the weight ratio as white powder, it mixed with the fluorescent pigment which mixed FA-005 ana, and what distributed it in the acrylic binder was printed and formed
[0012] Next, after cutting the acrylic board in which the fluorescence scattering layer was formed as mentioned above according to the desired pattern and grinding all the end faces (cutting plane) of an acrylic board, the light guide plate 2 with which the fluorescence scattering layer 3 was formed was obtained by forming the reflecting layer 4 which becomes a polished surface from aluminum.
[0013] Two places and a hole are established in the end face of the aforementioned light guide plate 2, and it is the luminescence wavelength of 480nm to the hole. The field-like light source of this invention was obtained by embedding at a time one blue Light Emitting Diode which consists of a gallium-nitride system compound semiconductor which has 1200micro of radiant power outputs W, respectively. When blue Light Emitting Diode of this field-like light source was made to turn on simultaneously, almost uniform white field-like luminescence which wore yellowness a little was obtained from the luminescence observation side side of a light guide plate 2. furthermore, the place which installed the optical diffusion board 5 with which mat processing was beforehand given to the luminescence observation side side, and the reflecting plate by which the barium-titanate layer 6 was applied on the aluminum base 7 at the fluorescence scattering layer 3 side, and was used as the light source for back lights -- from the optical diffusion board 5 side -- perfect -- the shape of a field -- uniform white luminescence was obtained Brightness was 55 cd/m2.
[0014] the [example 2] fluorescence scattering layer 3 -- as a yellow fluorescent dye -- LumogenF of BASF A.G. Equivalent mixture of Orenge-240 is carried out mostly. as Yellow-083 and an orange fluorescent dye -- company make -- Form with the fluorescent dye which dissolved them in butyl carbitol acetate using what mixed the barium titanate at a rate of 1 (color):200 by the weight ratio as white matter, and also When the field-like light source of this invention was obtained like the example 1, almost uniform field-like luminescence was observed. When considered as the light source for back lights still more nearly similarly, completely uniform field-like luminescence was observed.
[0015]
[Effect of the Invention] As explained above, the field-like light source of this invention became possible [realizing the field-like light source by Light Emitting Diode excellent in reliability] by moreover having the fluorescence scattering layer containing the fluorescent substance which can carry out wavelength conversion by blue Light Emitting Diode, and white powder in the field of one of the two of a light guide plate using blue Light Emitting Diode. And since the white powder of a fluorescence scattering layer has the operation which reflects the light by which wavelength conversion was carried out with the fluorescent substance, and makes it spread, there is little amount of the fluorescent substance used to be used, and it ends. Furthermore, since a Light Emitting Diode chip and a fluorescent substance do not touch directly, a convenient thing has little degradation of a fluorescent substance, and it does not cause color tone change of the field-like light source over a long period of time to it. Furthermore, about a color tone, arbitrary color tones including white can be offered by changing the kind of a fluorescent substance and white powder, the amount of mixtures, etc.
[0016] When the radiant power output of blue Light Emitting Diode most preferably used as a side which excites a fluorescence scattering layer on the other hand considers as the thing more than 200microW, wavelength conversion can be efficiently carried out with a fluorescent substance, and the field-like light source with a bright big area can be realized. Thus, the field-like light source of this application is also applicable to the illumination formula operation switch not only using the light source for back lights but the fluorescent substance etc.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

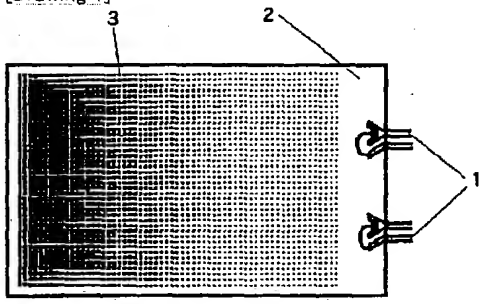
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The plan which looked at the light guide plate 2 of the field-like light source of one example of this invention from the fluorescence scattering layer 3 side.
[Drawing 2] The type section view at the time of mounting the field-like light source of one example of this invention as a back light.
[Description of Notations]
1 ..... Blue Light Emitting Diode
2 ..... Light guide plate
3 ..... Fluorescence scattering layer
4 ..... Reflecting layer
5 ..... Optical diffusion board
6 ..... Scatter reflection layer
7 ..... aluminum base

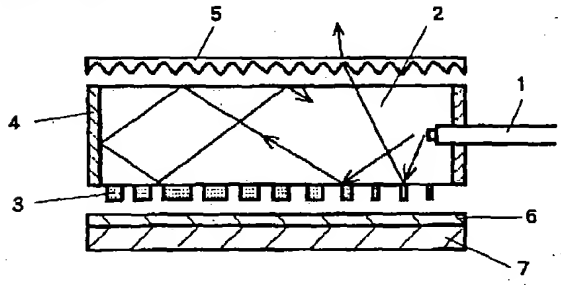
[Translation done.]

DRAWINGS

[Drawing 1]



[Drawing 2]



[Translation done.]